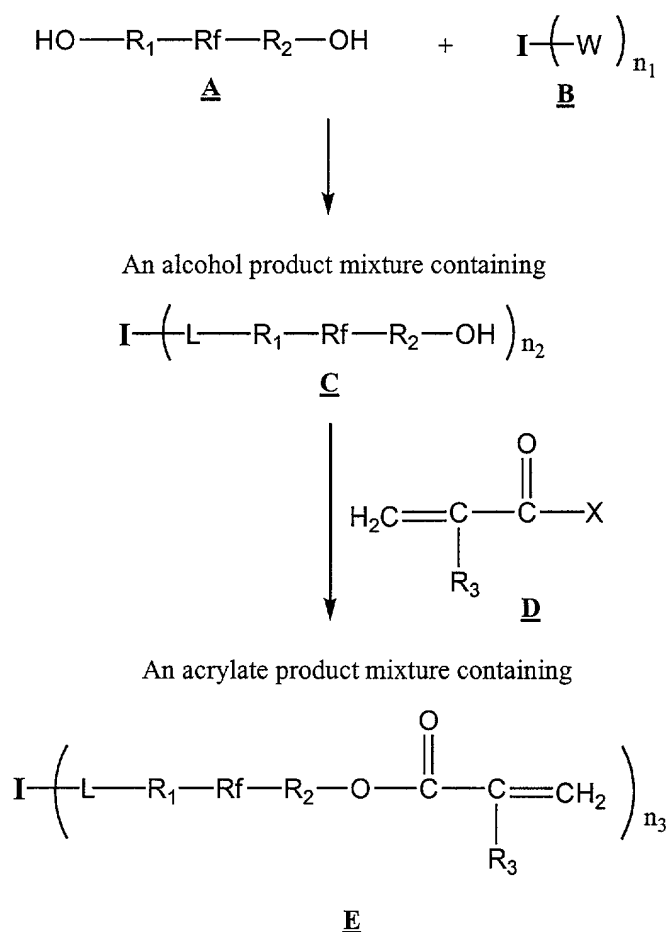


Claims

1. A photosensitive composition comprising:

- a) at least one fluorinated, non-urethane containing multifunctional acrylate prepared from at least one multifunctional alcohol, said alcohol being synthesized from a core molecule having at least two equivalents of hydroxy-reacting functional groups and a fluorinated molecule having at least two hydroxyl groups; and
- b) at least one photoinitiator.

2. The photosensitive composition of Claim 1, wherein the non-urethane containing multifunctional acrylate is prepared using the following reaction scheme:



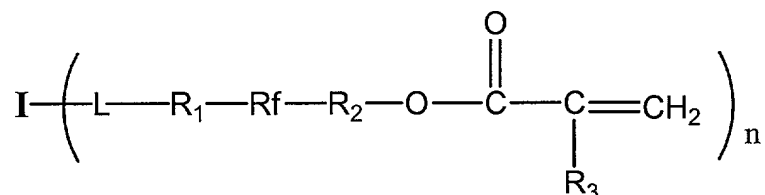
wherein **A** is a fluorinated monomer or polymer having two hydroxyl groups, wherein R_f is a monomeric or polymeric perfluorinated alkylenediyl, alkylene oxide, arylenediyl, arylene oxide, and mixtures thereof, and R_1 and R_2 are monomeric or polymeric divalent moieties such as alkylenediyl, alkylene oxide, alkylene sulfide, arylenediyl, arylene oxide, arylene sulfide, siloxane and mixtures thereof; **B** is a multifunctional molecule wherein **I** is a multivalent radical, W stands for one equivalent of hydroxy-reacting functional group and n_1 is at least 2; **C** is the multifunctional alcohol product mixture from **A** and **B**, wherein L is an ether or ester link and n_2 is at least 2; **D** is an acryloylation agent, wherein X is selected from OH, Cl and alkoxy; and **E** is the acrylate product mixture from **C** and **D**, wherein R_3 is H or CH_3 and n_3 is at least 2.

3. The photosensitive composition of Claim 2 wherein n_i ($i=1-3$) independently ranges from 3 to 6.

4. The photosensitive composition of Claim 2 wherein there are at least 2.5 equivalents of OH groups from **A** for every equivalent of hydroxy-reacting group, W , from **B**.

5. The photosensitive composition of Claim 2 wherein L is an ester link.

6. The photosensitive composition of Claim 2, wherein the acrylate **E** has the formula of:



wherein n ranges from 3 to 6.

7. The photosensitive composition of Claim 2 wherein R_f is a perfluorinated poly(methylene) moiety having at least 4 carbon atoms.

1 8. The photosensitive composition of Claim 2 wherein Rf is a perfluorinated
2 poly(alkylene oxide) moiety having at least 4 carbon atoms.

1 9. The photosensitive composition of Claim 2 wherein **B** is selected from a group
2 consisting of multifunctional carboxylic acid, acid chloride, ester and anhydride.

1 10. The photosensitive composition of Claim 2 wherein **B** is selected from 1,3,5-
2 benzenetricarbonyl trichloride, trimethyl-1,3,5-benzenetricarboxylate and 1,2,4-
3 benzenetricarboxylic acid.

1 11. The photosensitive composition of Claim 2 wherein **B** is selected from 1,2,3,4-
2 butanetetracarboxylic acid and tetraethyltrimethyl-1,1,2,2-ethanetetracarboxylate.

1 12. The photosensitive composition of Claim 1 wherein the acrylate has a number
2 average molecular weight of at least 500.

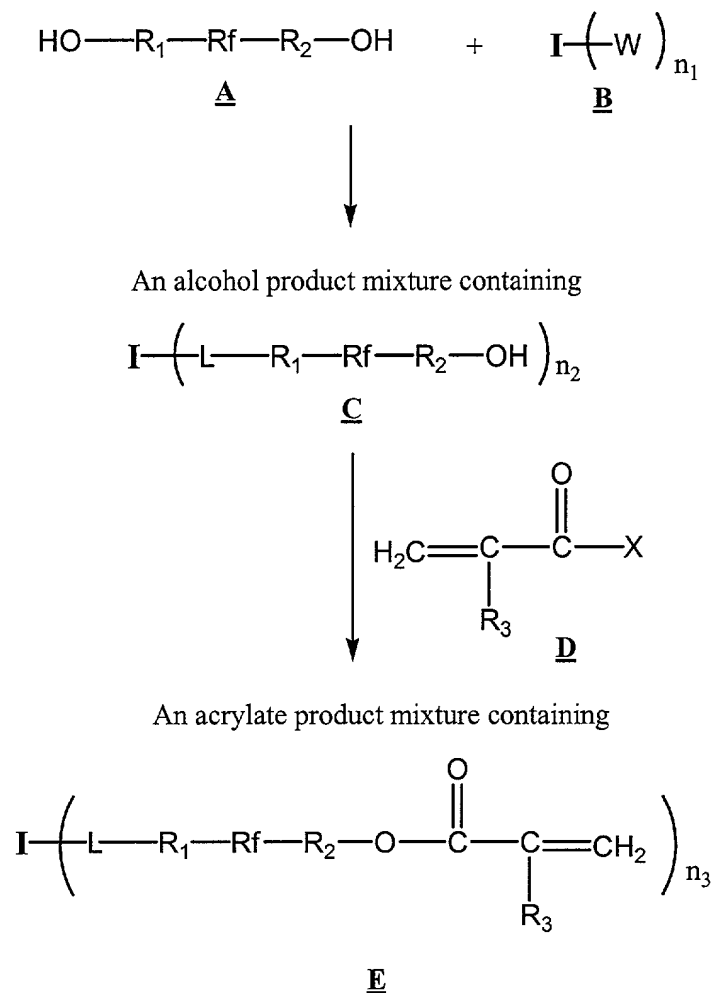
1 13. The photosensitive composition Claim 1 wherein the photoinitiator composition is a
2 mixture of at least two different photoinitiators.

1 14. A waveguide device having a light-transmitting structure formed on a substrate by
2 patterning the photosensitive composition comprising:

3 a) at least one fluorinated, non-urethane containing multifunctional acrylate prepared
4 from at least one multifunctional alcohol, said alcohol being synthesized from a core molecule
5 having at least two equivalents of hydroxy-reacting functional groups and a fluorinated molecule
6 having at least two hydroxyl groups; and

7 b) at least one photoinitiator.

15. The waveguide device of Claim 14 wherein the multifunctional acrylate is prepared using the following reaction scheme:



wherein **A** is a fluorinated monomer or polymer having two hydroxyl groups, wherein Rf is a monomeric or polymeric perfluorinated alkylenediyl, alkylene oxide, arylenediyl, alkylene oxide, and mixtures thereof, and R₁ and R₂ are monomeric or polymeric divalent moieties such as alkylenediyl, alkylene oxide, alkylene sulfide, arylenediyl, alkylene oxide, alkylene sulfide, siloxane and mixtures thereof; **B** is a multifunctional molecule wherein **I** is a multivalent radical, W stands for one equivalent of hydroxy-reacting functional group and n₁ is at least 2; **C** is the multifunctional alcohol product mixture from **A** and **B**, wherein L is an ether or ester link and n₂

is at least 2; **D** is an acryloylation agent, wherein X is selected from OH, Cl and alkoxy; and **E** is the acrylate product mixture from **C** and **D**, wherein R₃ is H or CH₃ and n₃ is at least 2.

16. The waveguide device of Claim 14, wherein the waveguide structure is patterned with an actinic radiation.

17. The waveguide device of Claim 14, wherein the waveguide structure is patterned with reactive ion etching (RIE).

18. A thermo-optic device comprising a waveguide structure of Claim 14 and at least one resistive heater.

19. The waveguide device of Claim 14 wherein said waveguide structure containing at least one optical grating element.

20. The waveguide device of Claim 19 wherein said device comprising at least one resistive heater.

21. A method to produce a waveguide device having a light-transmitting structure formed on a substrate by forming a coating of a photosensitive composition on a substrate and patterning the coating with an actinic radiation, said composition comprising:

a) at least one fluorinated, non-urethane containing multifunctional acrylate prepared from at least one multifunctional alcohol, said alcohol being synthesized from a core molecule having at least two equivalents of hydroxy-reacting functional groups and a fluorinated molecule having at least two hydroxyl groups; and

b) at least one photoinitiator.

1 22. A method to produce a waveguide device having a light-transmitting structure
2 formed on a substrate comprising:

3 a) coating a layer of a first composition of at least one fluorinated, non-urethane
4 containing multifunctional acrylate prepared from at least one multifunctional alcohol, said
5 alcohol being synthesized from a core molecule having at least two equivalents of hydroxy-
6 reacting functional groups and a fluorinated molecule having at least two hydroxyl groups; and at
7 least one photoinitiator on a substrate and exposing the layer to an actinic radiation to form a
8 bottom cladding layer with a first refractive index, n_1 ;

9 b) coating a thin layer of a second composition of at least one fluorinated, non-urethane
10 containing multifunctional acrylate prepared from at least one multifunctional alcohol, said
11 alcohol being synthesized from a core molecule having at least two equivalents of hydroxy-
12 reacting functional groups and a fluorinated molecule having at least two hydroxyl groups; and at
13 least one photoinitiator on top of the bottom cladding layer and patternwise exposing the thin
14 layer to an actinic radiation through a photomask with a desired feature to form a latent image in
15 a core layer;

16 c) removing the non-exposed portions in the core layer with an organic solvent to form a
17 waveguide rib with a second refractive index, n_2 , wherein n_2 is greater than n_1 ; and

18 d) coating a thin layer of a third composition of at least one fluorinated, non-urethane
19 containing multifunctional acrylate prepared from at least one multifunctional alcohol, said
20 alcohol being synthesized from a core molecule having at least two equivalents of hydroxy-
21 reacting functional groups and a fluorinated molecule having at least two hydroxyl groups; at
22 least one photoinitiator on top of the core layer and the bottom cladding layer and exposing the

layer of the third composisiton to an actinic radiation to form a top cladding layer with a third refractive index, n_3 , wherein n_3 is less than n_2 .

1 23. A waveguide device fabricated using the method of Claim 22.

1 24. The waveguide device of Claim 23, wherein $n_1 = n_3$.

[illegible]